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DEPARTMENT OF COMMERCE - BUREAU OF MINES

GEOPHYSICAL ABSTRACTS

NO. III

BY

FREDERICK W. LEE

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DEPARTMENT OF COMMERCE - BUREAU OF MINES

GEOPHYSICAL ABSTRACTS [1]

No. 3

Compiled by Frederick W. Lee [2]

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1 The Bureau of Mines will welcome reprinting of this article, but requests that the following footnote acknowledgment be used: "Printed by permission of the Director, U. S. Bureau of Mines. (Not subject to copyright.)"

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1 - GRAVITATIONAL METHODS

PRACTICAL APPLICABILITY OF DIFFERENT TYPES OF TORSION BALANCES, ESPECIALLY OF HAFF'S TORSION BALANCE

By H. Winkelmann

Gerland's Beiträge zur Geophysik, Band 19,
Heft 2/3, Leipzig, 1928, pp. 321-333.

The author, who himself has worked in the field with various types of torsion balances, expresses in the article his experience with the recently marketed Haff-Torsion-Balance. The advantages of practical work with Haff's torsion balance as compared with other types are mentioned. In spite of low weight and corresponding small dimensions (Model M = 28.5 kg., Model Al = 11.5 kg. the sensitiveness is not less than that in the largest instruments. It is at 1.10^{-9}, which is proved by calculations. A comparison with the corresponding values of other types of torsion balances (Eötvös, Askania, Gepege) is given. The mechanical features of the instrument are briefly described, and the balance is illustrated by a cross section of it. -- W. Ayvazoglou.

DETERMINATION OF THE ELEMENTS OF THE MAGNETIC AND GRAVITATIONAL FIELDS INDUCED BY AN INFINITELY LONG HOMOGENEOUS CYLINDER

By G. A. Gamburzeff

Gerlands Beiträge zur Geophysik, Band 19,
Heft 2/3, Leipzig, 1928, pp. 210-230.

The present work is a contribution to the question of the reason for the magnetic and gravitational anomalies in the government of Kursk (Russia).

For the purpose of determining from the data of a magnetic and gravimetric survey the distribution of the masses causing this magnetic and gravitational anomaly, it has been necessary to obtain formulas that would provide the simplest way of calculating the elements of the magnetic and gravitational fields of an infinitely long cylinder or prism. Such formulas adequate for graphical calculation are given in the first part of the article. In the second part (carried out together with Mr. M. Polikarpoff) the authors intend to solve the question whether the magnetic and gravitational anomalies can be explained by the deposits of iron quartzites discovered by deep-boring work in the region of Stschigry.

Theoretical values for the elements of the magnetic and gravitational fields $\left(\frac{\partial W}{\partial Z}, \frac{\partial W}{\partial y}, \frac{\partial^2 W}{\partial y \partial z}, H \text{ and } Z\right)$ are calculated in a graphical way by means of the formulas established by Gamburzeff in the first part. The values obtained by calculations and observations agree one with another, and thus the anomalies can be explained as caused by the iron deposits, on condition that these deposits reach a depth of not over 7 kilometers.

The results of the calculations are given in tables and diagrams. -- W. Ayvazoglou.

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THE ADVANTAGES OF CONTINUOUS RECORDING OF THE OSCILLATIONS OF THE BEAM OF A GRAVITATIONAL VARIOMETER (In Russian)

By S. Ghirin

Bulletin of the Institute of Practical Geophysics,
No. 2, Leningrad, 1926, pp. 196-200.

The author compares the two methods of registering the state of equilibrium of the beam of a gravitational variometer:

1. By a continuous recording of the oscillations of the beam;
2. By a momentary (point) recording of the state of equilibrium after the full damping of the beam.

The main advantages of the first method, such as saving in the time necessary for observations (almost 50%) and a simpler construction of the instrument (no additional devices for artificial damping of the beam), are mentioned especially. Five diagrams showing the spirals of continuous recording of the oscillations are given. -- W. Ayvazoglou.

NEUERUNG AN DREHWAGEN

(IMPROVEMENTS MADE ON TORSION BALANCE)

By W. P. Jenny

Zeitschrift fuer Practische Geologie, vol. 9, 1928,
pp. 141-143.

The impossibility of obtaining an accuracy of over $\pm$5E for a mean value of three measurements taken by a torsion balance at stations situated from 10 to 20 meters one from another, in case these measurements are influenced by too strong local effects caused by heterogeneous subsoil or by an intersected terrain, results in the necessity of finding a means for the increase of this accuracy. To do this the author proposes to take several measurements at each station with different heights of the scale beam, and explains a special arrangement of the foot by which the beam automatically sinks for a distance fixed in advance after a series of four, five, or six measurements is registered. This improvement must be considered important, as it offers the sole possibility of an exact control of local effects as well as of the work of several observers; besides, it constitutes the only means by which measurements in a very intersected terrain are possible.

By using a torsion balance provided with this new improvement, questions concerning the organization of the work and the utilization of the personnel can be solved more easily, thus these questions need not be neglected from the viewpoint of economy. -- W. Ayvazoglou.

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A PRELIMINARY REPORT ON THE GRAVITATIONAL SURVEY OF THE JLETSKY SALT DOME IN THE SUMMER OF 1925 (In Russian)

By P. Nikiforov

Bulletin of the Institute of Practical Geophysics, No. 2, Leningrad, 1926, pp. 201-203.

A surveying expedition was organized to establish the boundaries of salt deposits near the city of Jletsk (Province of Orenburg), the richest in Russia.

According to estimates made by Prof. D. Mushketov, the deposits surpass forty hundred billion pounds. The salt is 99 per cent pure NaCl. The gravitational method was used for establishing the contours of the deposit; the results and data of investigation are to be published. -- W. Ayvazoglou.

2 - MAGNETIC METHODS

THE LABORATORY WORK OF THE MAGNETIC SECTION OF THE INSTITUTE OF PRACTICAL GEOPHYSICS OF THE U.S.S.R. (In Russian)

By J. Bahurin

Bulletin of the Institute of Practical Geophysics, No. 3, Leningrad, 1927, pp. 283-307.

The present paper contains information on the laboratory work of the magnetic section of the Institute of Practical Geophysics in examining the precision of the Tieberg-Thalen instrument.

Twelve instruments were tested, and detailed data obtained with two of th are given in tables from the calculation of which the systematic and accidental errors in determination of the components of the magnetic field amount to 10 per cent for higher values of H and ΔZ and to 30 per cent for small values of them. As a considerable part of the errors are systematic, they may be reduced by accur calibration of the instrument by means of Helmholtz' rings.

In conformity with the results obtained, the author is of the opinion tha the instrument is sufficiently good for practical purposes, possessing the great advantages of being easily portable, simple in operation, and of solid constructi

In the second part of the article the author gives tables showing the magnetic properties of different rocks and ores determined by the magnetometric method. Pieces of rocks and ores in the form of cylinders of from 10 to 12 centimeters in length and about 1.5 centimeters in diameter were used for these tests. -- W. Ayvazoglou.

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3 - SEISMIC METHODS

THE EFFECTIVE MODULI OF ELASTICITY IN THE OUTER EARTH-SHELLS

By Reginald A. Daly, Harvard University, Cambridge, Mass.

Gerlands Beträge zur Geophysik, Band 19,
Heft 2/3, Leipzig, 1928, pp. 194-209.

The emergence-velocities of the longitudinal seismic wave (V) and transverse wave (v) for the Grundgebirge in Central Europe are 5.4 to 6.0 km./sec. and 3.2 or 3.3 to about 3.5 (?) km./sec., respectively; and V, just below the main discontinuity, which is generally described as 50 to 60 kilometers deep, is close to 7.9 km./sec. The emergence-velocities are higher than those expected in or quite near the surface of the Grundgebirge, if the effective elastic moduli were those which would be found by high-pressure tests on the average rock there existing - rock presumably not quite so incompressible as the average, fresh, flawless granite of the F. D. Adams and L. H. Adams experiments. This fact suggests some degree of failure of perfection in elasticity, the rock having higher effective moduli under the low-stress conditions of seismic waves than under the conditions of high pressure measurements in the laboratory.

Corroboration of this idea is found in an analysis of the hysteresis curves published by F. D. Adams and E. G. Coker.

The further suggestion is offered that the described high velocity of 7.9 km./sec. is similarly to be explained. Therewith increase of temperature is assumed partly to offset the probably tendency of increase of pressure to annul any imperfection of elasticity. However, below some such moderate depth as 120 kilometers and above the 2900-kilometer discontinuity, no failure of perfection in elasticity need be assumed.

The main question of this paper is the validity of the hypothesis that the material just below the "50 to 60 kilometer" discontinuity is basaltic (plateau-basalt). If perfectly elastic, holocrystalline plateau-basalt would give V the value of 7.2 to 7.3 km./sec. The difference from the "observed" value, 7.9 km./sec, is hypothetically explained by a rather slight departure of the basalt <u>in situ</u> from ideal elasticity. The assumption of a general earth-shell of peridotite near the surface of the globe does not agree with leading facts of geology and apparently is not compelled by the data of experimental physics.

A new explanation of the Conrad-Jeffreys-Mohorovicic discontinuity is also proposed for discussion. -- Author's abstract.

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CONSIDERING THE THEORY AND CONSTRUCTION OF VERTICAL SEISMOGRAPHS (With 5 figs.)

By J. Wilip, Tartu-Dorpat

Gerlands Beiträge zur Geophysik,
Band 19, Heft 4, Leipzig, 1928

In connection with the vertical seismographs of Wiechert and Galitzin, the theory of an altered type of seismograph with a two-spiral-spring-suspension system is derived. By introducing a second spiral spring with the lower point of application above the pendulum arm, the limping movement of the seismograph is transformed into sinusoidal action. The conditions for obtaining longer periods are discussed. The two spiral springs may be orientated in a horizontal direction as well, which in certain cases may be more advantageous - for example, for the mechanical method of registration. Two characteristics of periods, that of a one-spring system and of a two-spring system, are compared; in the latter case this curve is nearly a straight line; this means a constant inherent period in the wide reach of the declinations from the zero point. -- W. Ayvazoglou.

THE SEISMIC GEOPHYSICAL EXPLORATION METHOD

By Dr. R. Ambronn, Göttingen

The Mining Journal, vol. 164, Feb. 9, 1929, pp. 104-105.

The practical importance and the advantages of the seismic geophysical method of prospecting in connection with the development of the modern apparatus by which it is possible to determine with great exactness the depths of the ore bodies over wide areas (the error generally not exceeding 1 to 2 per cent), are mentioned in the present article. The results obtained with this method are considered by the author to be superior to the gravity measurements made by means of the torsion balance.

In consequence of the great improvements made in the instruments, the following advantages of the seismic geophysical method as compared with previous work are given especial emphasis:

1. Great reduction in the explosive charges to about 100th part of the charges necessary formerly, as it is to-day possible to obtain by the new apparat amplifications up to several million times without interference from the natural seismic ground movements.
2. Great technical and economical importance due to the fact that vibration receivers are no longer used individually and independently one from another but a number of them, suitably placed at different points, can be connected by electric wire with a central registering apparatus so that the records are united in a joint registration film (a figure shows such a film).
3. The registering apparatus mounted on an automobile remains unaffected by the shocks, so that no precaution during the recording is necessary.

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4. Small vibration receivers, mounted in the laboratory, can be used in the field without any special preparation. They transform when they receive the mechanical vibrations of the earth's surface and they automatically transform them into like-shaped electric current fluctuations, and the transformation relation is shown by the central registering apparatus for each individual receiver. A figure shows a film taken by means of such registering apparatus.

The uniting of the results obtained by explosions relating to a profile line is shown in a figure in the time curves. The geological profile derived from the registered system of time curves is shown through graphic construction and calculation.

The examples mentioned in the article demonstrate with what great accuracy it is possible to clear up even more complicated geologic structures by means of the seismic method of underground exploration. -- W. Ayvazoglou.

4 - ELECTRICAL METHODS

THEORETISCHE GRUNDLAGEN FUER DIE AUFFINDUNG VON STÖRUNGSKÖRPERN MITTELS SOLCHER GEOELECTRISCHER METHODEN, BEI DENEN ZWEI PUNKTFÖRMIGE ELECTRODEN ZUR ERZEUGUNG EINES KÜNSTLICHEN FELDES VERWANDT WERDEN

(THEORETICAL BASES FOR THE DETERMINATION OF THE INTERFERING BODIES BY MEANS OF GEOELECTRIC METHODS IN WHICH THE ARTIFICIAL FIELD IS PRODUCED BY TWO-POINT ELECTRODES)

By J. N. Hummel, Berlin

Gerlands Beiträge zur Geophysik, Band 20, Heft, 3/4, Leipzig, 1928, pp. 281-287

If an artificial stationary field of current is produced in the inhomogeneous subsoil by means of spot or line electrodes, then in special cases the potential may be established. This is, for instance, possible if very good-conducting or nonconducting interfering bodies of an established shape are imbedded in the otherwise homogeneous isotropic medium and are disposed symetrically to the electrodes. The expedient which in such cases furnishes simple expressions for the potential is the method of sources and sinks ("Quellsenkmethode") which has been derived from the hydro and aero-dynamics. In a former essay we have uncovered the importance of the method of sources and sinks points for the theory of the geoelectric methods. In this instance the deposits are replaced by appropriately arranged points of swelling and sinking by the selection of which the shape of the interfering bodies, as well as the potential surfaces, is determined.

For the case that the field owes its coming into existence to two-spot electrodes, some such forms of bodies are stated and the equipotential lines at the surface of the earth calculated for an almost spherical deposit. The treatment of further cases not reckoned through here is hinted at. Amongst others a process worked out by N. Gella can obtain its scientific basis by very similar calculations. -- Author's abstract.

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GEOPHYSICAL PROSPECTING; ITS VALUE TO THE MINING GEOLOGIST

By John B. DeMille

Canadian Mining Journal, April 5, 1929, pp. 313-315.

Geophysical methods of prospecting have been widely accepted during the last five years as an essential aid in simplifying the problem of economically exploring rock areas.

Evidences of the increasing value of geophysical prospecting to the mining industry are summed up by the author as follows:

1. Half a dozen responsible companies for conducting geophysical surveys are organized in the United States and Canada.
2. Greatly improved apparatus is being developed through laboratory research and field experience.
3. The American Institute of Mining and Metallurgical Engineers has published a 700-page volume surveying the present important status of this new science and discussing some of its notable successes in commercial work.
4. American and Canadian mining companies are depending increasingly upon the results of geophysical surveys.
5. Geophysical surveying is recognized as assessment work by the Provincial Government in British Columbia, Manitoba, and Quebec, its recognition is under advisement in Ontario, and in the United States pressure is being brought to bear towards similar changes in the mining laws.
6. The United States Bureau of Mines has applied for an appropriation from Congress for approximately a quarter of a million dollars to finance geophysical research during the next five years.

In the opinion of the author, the preference for electrical methods of prospecting in comparison with the torsion balance, seismometer, and magnetometer methods for explorations in Canada is evident, the latter being more adapted for laboratory work rather than for field work.

A comparison of the five electrical methods (1 - self-potential, 2 - equipotential, 3 - megger, earth resistivity, 4 - low-frequency inductive, and 5 - high frequency inductive) is given in a table; in a second table are outlined the principal factors controlling the successful operation of the electrical methods.

According to the experience of the author, the high-frequency inductive method has proved its superiority in the field, being not only 50 per cent more rapid but also sufficiently sensitive to detect good conductors at depths of 500 feet. The method is besides of primary importance in eliminating areas having no commercial possibilities for development. Other electrical methods, as well as the magnetometer, may serve as effective supplements to the high-frequency method.

Successful use of geophysical prospecting depends, in general, on the competence of the operator in interpreting the reactions of this instruments, on the selection of the particular method suitable for working over the selected topographical and geological conditions, and on the cooperation of the prospecting crew while they are carrying on their observations. -- W. Ayvazoglou.

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UNTERSUCHUNG DER POTENTIALVERTEILUNG UM VERSCHIEDENE STÖRUNGSKÖRPER, DIE SICH IN EINEM AN UND FUER SICH HOMOGENEN FELDE BEFINDEN

(RESEARCHES ON THE POTENTIAL DISTRIBUTION ABOUT DIFFERENTLY FORMED INTERFERENCE BODIES EMBEDDED IN A HOMOGENEOUS MEDIUM)

By J. N. Hummel

Gerlands Beiträge zur Geophysik, Band 21,
Heft 2/3, Leipzig, 1929, pp. 204-214

The potential distribution about differently formed interference bodies is given; the interference bodies are embedded in an isotropic homogeneous medium, through which passes a stationary current, which is in itself homogeneous. We are dealing in particular with the theoretically and practically important case that good-conducting rod-shaped rotary bodies, which may be compared with straight going ways or veins, lie with their longitudinal axis in the direction of the current. The expedient, which gives expressions for the potential, consists in the method of sources and sinks which is very often employed for similar problems.

The implacements are in this case replaced by suitably selected swelling systems, by the choice of which the shape of the interferring bodies and also the potential surfaces are established.

By testing with different swelling and sinking arrangements one can succeed in getting the desired shapes of the bodies. For such an imbedding of definite shape, which is at a certain depth under the surface of the earth, the potential on the upper surface may be exactly calculated, and the corresponding potential chart can be drawn. -- Author's abstract.

UEBER TURBULENTE EIGENSTRÖME DER OBERSTEN ERDSCHICHTEN UND IHRE BEZIEHUNGEN ZU DEN GESTEINSGRENZEN

(THE TURBULENT SELF-EXCITING CURRENTS IN THE EARTH'S UPPER LAYERS AND THEIR RELATIONS TO THE BOUNDARIES OF THE ORE DEPOSITS)

By H. Hunkel

Zeitschrift fuer Practische Geologie, vols. 7
and 9, 1928, pp. 103-109 and 143-149.

In addition to two kinds of spontaneous currents known in the earth's upper crust, a third type one, called by the author the "turbulent self-exciting currents" (Turbulenten Eigenströme) is discussed in the article; the peculiarities of these currents are explained.

The existence of self-exciting currents, caused by spatial poles of small dimensions, scattered irregularly and circulating in all directions, leads to a method of determining the boundaries of ore bodies based on the theory of probabilities. The method was tried out on an area to the east of Darmstadt, and the results obtained from electric measurements were entirely confirmed in all cases by boring and digging.

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The use of the turbulent currents is explained from the physical viewpoin as being caused by the difference in concentrations of chemical compositions of the solutions of the soil. Thirteen diagrams illustrating the results obtained b the electrical method as well as by boring are given in the article.

Finally the author describes the instruments used by him and the technica procedure of his method; because of its unusual simplicity, rapidity, and surety, the method promises to become a useful additional means of making up special charts. -- W. Ayvazoglou.

UNTERSUCHUNG DER POTENTIALVERTEILUNG FUER EINEN SPEZIELLEN FALL IM HINBLICK AUF GEOELECTRISCHE POTENTIALLINIENVERFAHREN

(EXAMINATION OF THE DISTRIBUTION OF THE POTENTIAL IN A SPECIAL CASE WITH REGARD TO THE GEOELECTRIC METHOD OF POTENTIAL LINES)

By J. N. Hummel

Zeitschrift fuer Geophysik, Jahrg. 4, Heft 2, 1928, pp. 67-76.

Having in view that in electrical methods of prospecting by means of electrodes the dependence of the distribution of the potential on the distributi of the electric conductivity in the subsoil and on the arrangement of the source of the currents is of great importance, and that the possibilities of the use of these methods, of their depth effect, and especially the interpretation of the r sults of measurements must be studied carefully as well as a choice make of the most favorable form and arrangement of electrodes, the calculation and discussio of the potential distribution is considered by the author to be the basis for su researches.

With consideration of special cases, the author examines the distributio of the potential around an infinitely long hollow elliptic cylinder, the longitudinal axis of which lies perpendicularly in a homogeneous stationary fiel of current. Practical conclusions connected with the geoelectric methods in whi electrodes are used are derived from the results. -- W. Ayvazoglou.

BEITRÄGE ZUR GEOELECTRISCHEN METHODE

(CONTRIBUTIONS TO GEOELECTRIC METHODS OF PROSPECTING)

(With 14 diagrams)

By J. N. Hummel

Zeitschrift fuer Geophysik, Jahrg. 4, Heft 4, 1928, pp. 178-203.

The article is divided into three main chapters. In the first chapter Hummel discusses the importance of the effect of several layers with different electric conductivity in the discovery of interfering bodies lying beneath them.

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A potential function is established for the case in which the interfering bodies of different form and conductivity lie in a stratified medium through which a homogeneous stationary current is flowing. The author especially shows to what extent the disturbances of the normal potential surface picture, caused by the interstratification, are eliminated by overlying strata with better conductivity.

The second chapter deals with the influence of the unevenness of the terrai on the distribution of the potential in the subsoil. By calculation of several examples the author shows how this influence in a homogeneous isotropic subsoil can be determined in case a homogeneous stationary current is flowing through the ground.

Theoretical principles for the determination of elongated bodies of revolution and of further interstratifications are discussed in the third chapter. Here, the method of sources and sinks (Quellsenkmethode) adapted in hydrodynamics and aerodynamics, is used, and the importance of this method for the solution of geoelectric problems in general is indicated. -- W. Ayvazoglou.

UEBER DIE TIEFENWIRKUNG BEI GEOELECTRISCHEN POTENTIALLINIENMETHODEN

(THE EFFECT OF THE GEOELECTRIC METHOD OF POTENTIAL LINES WITH REGARD TO THE DEPTH OF AN ORE BODY)

By J. N. Hummel

Zeitschrift fuer Geophysik, Jahrg. 4, Heft 1, 1928, pp. 22-27.

The article deals with the electric method of prospecting, using two electrodes by means of which an electric current is sent into the conducting soil and the picture of current or potential lines formed at the surface of the ground is calculated. Conclusions on the structure of the subsoil may be derived from the variations of the picture obtained in reality by the comparison of it with the well-known regular picture obtained in case the subsoil is a homogeneous medium. Proceedings necessary for the establishment by this method of the depth at which an ore body is embedded (Tiefenwirkung) are examined. The author gives calculations on the thickness of the layer covering the deposit at which the indications on the surface of the earth can still be obtained. Two special cases are discussed. -- W. Ayvazoglou.

PHYSIKALISCHE GRUNDLAGEN EINER NEUEN GEOELECTRISCHEN AUFSCHLUSSMETHODE

(PHYSICAL PRINCIPLES OF A NEW GEOELECTRIC METHOD OF PROSPECTING)

By J. N. Hummel

Zeitschrift fuer Geophysik, Jahrg. 4, Heft 2, 1928, pp. 59-67.

Mathematical conclusions on the proceedings connected with the method elaborated by K. Sundberg are given by the author for a simple case. Values

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obtained by calculations are compared with those obtained from experiments. The complications which as a rule will occur under the real conditions are mentioned.

The author examines the question of how the magnetic alternating field is influenced by the subsoil and what conclusions may be derived from the data obtained. A simple case, that of a layer with a considerably high conductivity covered by layers having a comparatively low conductivity, is discussed. Under this supposition the conditions for a theoretical establishment and the data obtained are considered by him to be of sufficiently close approximation to those existing in reality.

Eight diagrams supplement the mathematical conclusions. -- W. Ayvazoglou.

7 - UNCLASSIFIED METHODS

ARBEITS-GEBIETE DER ANGEWANDTEN GEOPHYSIK

(FIELDS OF OPERATIONS OF APPLIED GEOPHYSICS)

By Dr. F. Muller

Zeitschrift fuer practische Geologie,
vol. 5, 1928, pp. 67-71.

In addition to the fields of operations of geophysical methods of prospecting already explored in connection with prospecting of ore deposits, the author mentions the fields which so far have been investigated to a certain degree only. He describes the methods of investigations which can be applied for the discovery of water, giving to the mining geologist valuable and essential information. For example, in dry regions water horizons in the subsoil may be established by means of electromagnetic waves, owing to their property of being reflected by water. Th presence of water may also be determined by seismic measurements, as the elastic properties of water are different from those of the upper dry layers. Examples where the possibility or impossibility of discovering water exists are discussed and illustrated by diagrams.

Another important field of operations of applied geophysics is that of studying the conditions and structure of the earth's surface in connection with th erection of buildings. Here the question is of collecting data on the thickness, homogenousness, etc., of the layers supporting the uppermost strata in order to determine not only the possible static load but also the behavior of the subsoil and its capability of resistance to the dynamic load occurring from elastic oscillations and from other mechanical reasons.

The determination and measurement of the capability of the resistance of the buildings to shocks as depending on the specific property of materials may be accomplished by applying the Sieberg-Cancanic scale, used in seismics, which deals with relations of the dangerous influences of the shocks as well as accelerations transmitted to the particles of the soil; these relations are established by the

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formula $\beta = \frac{4a}{\tau^2}$ (a - amplitude of the soil; τ - time of the oscillation of the subsoil; and β - acceleration of the particles at the soil.) The geophysical prospecting of the subsoil becomes especially important in case of barring river valleys and making other hydraulic works.

The determination of the structure of the subsoil may as a rule be accomplished by using the radioactive measurements.

Thus in addition to geological researches, applied geophysics may serve also for the solution of many other problems. Geophysicists should pay attention to the fields of application of geophysical methods mentioned above. -- W. Ayvazoglou.

FLACHLANDSGEOLOGIE UND GEOPHYSIKALISCHE UNTERGRUNDFORSCHUNG

(STUDY OF THE GEOLOGY OF PLAINS AND THE SUBSOIL PROSPECTING BY MEANS OF GEOPHYSICAL METHODS)

By H. Reich, Berlin

Zeitschrift fuer practische Geologie,
Heft 8, August, 1928, pp. 128-131

The influence of petrographic peculiarities of diluvial and alluvial deposits upon the gravitational, seismic, magnetic, and electric methods of prospecting are discussed.

All the methods mentioned may be used with success except the torsion-balance method, for which the irregular formations of the terminal moraine make sometimes a correct calculation almost illusory, as, owing to the irregular distribution of the density of glacial sediments, errors up to 21 Eötvös are veryprobable and even greater errors are possible. The physical structure of diluvial rocks makes geophysical prospecting possible; their great porousness facilitates a general moistening of them, thus their electrical conductivity is increased accordingly. The mechanical destruction of magnetic rocks mixed with the sediments prevents their strong magnetic effect. The stratification of diluvial rocks, which in general is not very solid, requires only a slow velocity of propagation of elastic waves; their small density makes the discovery of the presence of more solid rocks in the diluvial subsoil possible.

The physical effects of the diluvial glacier deposits were studied on the large areas of the North German plain, which is especially favorable for geophysical researches. Some data on the velocity of longitudinal waves, as well as on the specific electric resistances in connection with the percentage of water for different rocks at different places, are given. -- W. Ayvazoglou.

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PROSPECTING AND STUDY OF ORES BY THE GEOLOGICAL COMMITTEE IN THE U.S.S.R. (In Russian)

By V. K. Kotulsky

Bulletin du Comité Géologique,
vol. 27, No. 2, Leningrad, 1928.

The attainments of the Geological Committee of the U.S.S.R. in geophysical methods of prospecting during the five years from 1923 to 1928 are briefly described.

Figures showing the high yearly development of the work may best illustrate this progress.

Areas Investigated (In Square Kilometers):

	1923	1924	1925	1926	1927
By magnetic methods	16	110	215	260	526
By electric methods	--	3	38	52	80
By gravimetrical methods	--	--	4	250	325
By radioactive methods	--	--	--	20	50

Progress in Magnetic Methods.- Theoretical studies to determine the magnetic field for bodies having the form of ellipsoids of revolution are to be mentioned especially. A new apparatus is constructed which gives more accurate data on weak magnetic ores than those obtained by Tiberg-Thalen instruments; the new apparatus besides has a smaller weight, is more easily portable, and is more sensitive. Improvements on the Tiberg-Thalen apparatus were made. More than 1,200 square kilometers were investigated by this method. Detailed investigatio of about 230 square kilometers were made in the regions of Krivoy Rog, Mount Blagodat, Magnetic Mountain in the Urals, and at other places.

Electric Methods.- The method of equipotential lines and that of determi ing the intensity or induction were studied carefully. As all the phenomena in connection with the method of equipotential lines could not be explained by mathematical analysis, special experimental researches for the determination of the form of the normal field, as well as for clearing up of anomalies caused in the field by the conducting lines were accomplished in the following way: A bod representing the deposit was put into a tank filled with water and the electrode were put over the surface of the water. Observations were made by using the tel phone, and the drawing of equipotential lines was performed by a pantograph adapted in a clever manner for this purpose.

In this way the phenomena caused by conductors of different forms and placed differently with regard to the electrodes and the surface of the water we studied. Some principles which ought to be taken into consideration for the deciphering of the results, as well as for the contouring of an ore body according to the lines of gradients, could be established.

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Notwithstanding this, there are still phenomena, especially if investigations in dry countries are made, by which the method of equipotential lines can not be considered to be satisfactory; the Geological Committee expressed the desire that these phenomena be studied especially.

Essentially the study of the method of intensity or induction consisted of investigating the electromagnetic field created under the influence of an alternating current sent into the earth or directed along a closed loop.

The elements of the field are determined by means of a frame and the intensity is measured either by the aid of an audion voltmeter or by the method of two frames.

Theoretical calculations of the normal field are considered by the author to have been made by the geophysicists working for the Geological Committee of the U.S.S.R. independently from those studying this question abroad. These calculations were verified in practice. In addition to these two methods, already tried out in prospecting, preliminary experiments with short waves, as well as an improvement on Chilson's method, were made. After a series of preliminary experiments a special transmitter was constructed, and the first trials on the terrain were to be performed.

An "experimental field" for preliminary elaboration of new methods of electric researches and for the testing of instruments was arranged.

Good results were obtained by using the method of equipotential lines for discovering ore bodies lying under alluvial deposits. The discoveries were verified by digging and boring.

Gravitational Method: The results obtained by using the gravitational method of prospecting were very favorable; this method is considered important for detailed investigation, especially on a covered terrain.

A series of improvements in the existing variometers was made.

Radioactive Method: The radioactive method was developed in two directions: On the one hand a method for determining the radioactivity of ore-samples available from the collections of the Geological Committee was studied, and on the other hand researches on radioactive elements in the fields were made. For the determination of the radioactivity of the ore-samples a special apparatus, provided with a cover inside of which a box with samples is placed, was constructed; the amount of ions in the air sucked through it is measured by Ebert's electrometer. Only from 5 to 10 minutes are required for this determination. More than one million ore samples are at the disposal of the Geological Committee. About 15 per cent of all samples have already been examined, and a series of indications of ore deposits, most of them in Turkestan, has been obtained. A similar device was tried for field work and proved to be satisfactory. -- W. Ayvazoglou.

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